CLAIMS

1. Nematic liquid crystal display device presenting two stable states, without an electric field, that are obtained by anchoring break, the two stable states corresponding to two textures of liquid crystal molecules, the twisting of which differs by 150° to 180° in absolute values, characterized by the fact that it comprises two polarizers (10, 40), the first polarizer (10) being placed on the side of the observer, the other polarizer (40) being placed on the opposite face of the liquid crystal cell, the orientation of the two polarizers being shifted by a value equal to the rotatory power of the cell +/- $\pi/2$, the rotatory power corresponding to the effect of the most twisted texture.

2. Device according to claim 1, characterized by the fact that the optical delay Δnd is of the order of 240 +/- 80 nm.

3. Device according to one of claims 1 or 2, characterized by the fact that the orientation of the polarizer placed on the opposite side with respect to the observer, as referring to the nematic director on the associated face of the cell, is comprised within the range containing the sub-range +/- (20° to 70°) whilst the orientation of the polarizer placed on the side of the observer, as referring to the same nematic director reference, is comprised within the range comprising the sub-range from +/- (20° to 70°).

4. Device according to one of claims 1 to 3, characterized by the fact that for a levo-rotatory liquid crystal, the orientation of the polarizer placed on the opposite side with respect to the observer is comprised within the range comprising the sub-ranges -70° to -40° and 20° to 55° whilst the orientation of the polarizer placed on the side of the observer is comprised within the range comprising the sub-ranges -55° to -20° and 35° to 70°, and for a dextro-rotatory liquid crystal, the orientation of the polarizer placed on the opposite side with respect to the observer is comprised within the range

comprising the sub-ranges -55° to -20° and 40° to 70° whilst the orientation of the polarizer placed on the side of the observer is comprised within the range comprising the sub-ranges -70° to -35° and 20° to 55°.

5. Device according to one of claims 1 to 4, characterized by the fact that the twist angle of the molecules in one of the two stable states is comprised between 0° and 15°.

6. Device according to one of claims 1 to 5, characterized by the fact that the twist angle of the molecules in one of the two stable states is comprised between 0° and 15°, the optical delay Δnd = 200 +/- 40 nm and for a levo-rotatory liquid crystal, the orientation of the polarizer on the opposite side with respect to the observer is comprised within the range [-60°; -40°] U [30°; 50°], whilst the orientation of the polarizer on the side of the observer is comprised within the range [-50°; -25°] U [40°; 70°].

7. Device according to one of claims 1 to 5, characterized by the fact that the twist angle of the molecules in one of the two stable states is comprised between 0° and 15°, the optical delay Δnd = 200 +/- 40 nm and for a dextro-rotatory liquid crystal, the orientation of the polarizer on the opposite side with respect to the observer is comprised within the range [-50°; -30°] U [40°; 60°], whilst the orientation of the polarizer on the side of the observer is comprised within the range [-70°; -40°] U [25°; 50°].

8. Device according to one of claims 6 or 7, taken in their dependence on claims 1 or 3 to 5, characterized by the fact that the optical delay Δnd is of the order of 210 ± 50 nm.

9. Device according to one of claims 1 to 5, characterized by the fact that the twist angle of the molecules in one of the two stable states is comprised between 0° and 15°, the optical delay Δnd = 280 +/- 40 nm and for a levo-rotatory liquid crystal, the orientation of the polarizer on the opposite side with respect to the observer is comprised within the range

[-65°; -45°] U [25°; 50°], whilst the orientation of the polarizer on the side of the observer is comprised within the range [-50°; -20°] U [40°; 70°].

10. Device according to one of claims 1 to 5, characterized by the fact that the twist angle of the molecules in one of the two stable states is comprised between 0° and 15°, the optical delay Δnd = 280 +/- 40 nm and for a dextro-rotatory liquid crystal, the orientation of the polarizer on the opposite side with respect to the observer is comprised within the range [-50°; -25°] U [45°; 65°], whilst the orientation of the polarizer on the side of the observer is comprised within the range [-70°; -40°] U [20°; 50°].

11. Device according to one of claims 1 to 5, characterized by the fact that the angle formed by the brushing directions between themselves is comprised between 10° and 15°, the optical delay Δnd = 200 +/- 40 nm and for a levo-rotatory liquid crystal, the orientation of the polarizer on the opposite side with respect to the observer is comprised within the range [-55°; -35°] U [35°; 55°], preferentially [-40°; -50°] U [40°; 50°], whilst the orientation of the polarizer on the side of the observer is comprised within the range [-45°; -25°] U [45°; 70°], preferentially [-45°; -25°] U [50°; 65°].

12. Device according to one of claims 1 to 5, characterized by the fact that the angle formed by the brushing directions between themselves is comprised between 10° and 15°, the optical delay Δnd = 200 +/- 40 nm and for a dextro-rotatory liquid crystal, the orientation of the polarizer on the opposite side with respect to the observer is comprised within the range [-35°; -55°] U [35°; 55°], preferentially [-40°; -50°] U [40°; 50°], whilst the orientation of the polarizer on the side of the observer is comprised within the range [-70°; -45°] U [25°; 45°], preferentially [-65°; -50°] U [25°; 45°].

13. Device according to one of claims 1 to 5, characterized by the fact that the angle formed by the brushing directions between themselves is comprised between 0° and 10°, the optical delay Δnd = 200 +/- 40 nm and for a levo-rotatory liquid crystal, the orientation of the polarizer on the opposite side with respect to the observer is comprised within the range [-65°; -40°] U [25°; 50°], preferentially [-60°; -45°] U [30°; 45°], whilst the orientation of the polarizer on the side of the observer is comprised within the range [-55°; -25°] U [35°; 65°], preferentially [-50°; -30°] U [40°; 60°].

14. Device according to one of claims 1 to 5, characterized by the fact that the angle formed by the brushing directions between themselves is comprised between 0° and 10°, the optical delay Δnd = 200 +/- 40 nm and for a dextro-rotatory liquid crystal, the orientation of the polarizer on the opposite side with respect to the observer is comprised within the range [-50°; -25°] U [40°; 65°], preferentially [-45°; -30°] U [45°; 60°], whilst the orientation of the polarizer on the side of the observer is comprised within the range [-65°; -35°] U [25°; 55°], preferentially [-60°; -40°] U [30°; 50°].

15. Device according to one of claims 1 to 5, characterized by the fact that the angle formed by the brushing directions between themselves is comprised between 0° and 5°, the optical delay Δnd = 280 +/- 40 nm and for a levo-rotatory liquid crystal, the orientation of the polarizer on the opposite side with respect to the observer is comprised within the range [-70°; -45°] U [20°; 45°], preferentially [-65°; -50°] U [25°; 40°], whilst the orientation of the polarizer on the side of the observer is comprised within the range [-50°; -25°] U [40°; 65°], preferentially [-45°; -30°] U [45°; 60°].

16. Device according to one of claims 1 to 5, characterized by the fact that the angle formed by the brushing directions between themselves is comprised between 0° and 5°, the optical delay

Δnd = 280 +/- 40 nm and for a dextro-rotatory liquid crystal, the orientation of the polarizer on the opposite side with respect to the observer is comprised within the range [-45°; -20°] U [45°; 70°], preferentially [-40°; -25°] U [50°; 65°], whilst the orientation of the polarizer on the side of the observer is comprised within the range [-65°; -40°] U [25°; 50°], preferentially [-60°; -45°] U [30°; 45°].

17. Device according to one of claims 1 to 18, characterized by the fact that the ratio between the thickness d of the cell and the spontaneous pitch p_0, of the liquid crystal molecules, is approximately equal to 0.25 +/- 0.1, preferably 0.25 ± 0.05.

18. Method for the optimization of the orientation of two polarizers (10, 40) in a nematic liquid crystal display device presenting two stable states, without an electric field, that are obtained by anchoring break, the two stable states corresponding to two textures of liquid crystal molecules, the twisting of which differs by 150° to 180° in absolute values, characterized by the fact that it comprises the steps consisting of calculating the rotatory power of the cell and positioning the two polarizers (10, 40), the first polarizer(10) being placed on the side of the observer, the other polarizer (40) being placed on the opposite face of the liquid crystal cell, according to an orientation shifted by a value equal to the rotatory power of the cell +/- π/2, the rotatory power corresponding to the effect of the most twisted texture.

19. Method according to claim 18, characterized by the fact that the rotatory power PR is calculated on the basis of the relationship:

$$\mathrm{PR} \cong \phi - \mathrm{arctg}\left(\frac{\phi}{\mathrm{X}}\mathrm{tgX}\right) \qquad [3]$$

with $$X(\phi, \lambda) = \sqrt{\phi^2 + \left(\frac{\pi \Delta nd}{\lambda}\right)^2} \qquad [2]$$

20. Method according to one of claims 18 or 19, characterized by the fact that it comprises the steps consisting of:

- calculating the rotatory power PR using a formula which utilizes the optical delay Δnd, the twist Φ and the wavelength λ,
- fixing the orientation A of the output polarizer (10) equal to P+PR +/- π/2, P representing the orientation of the polarizer (40) on the side opposite to the observer and PR the rotatory power,
- researching the values of P which produce the highest resultant transmission value for a twist value equal to Φ +/- π in the case of infinite azimuthal anchoring or a twist value equal to Φ +/- π - 2.DE taking account of the elastic uncoupling and
- deducing A from it.

21. Method according to one of claims 18 to 20, characterized by the fact the transmission value is defined by the relationship:

$$\mathrm{Tas}(\phi,\lambda) = \cos^2(\alpha+\beta) - \cos^2\mathrm{X}\cos 2\alpha\cos 2\beta\left[\frac{\phi}{\mathrm{X}}\tan\mathrm{X} - \tan 2\alpha\right]\left[\frac{\phi}{\mathrm{X}}\tan\mathrm{X} + \tan 2\beta\right].$$

22. Method according to one of claims 18 to 21, characterized by the fact that the rotatory power PR is calculated on the basis of an optimal twist value Φopt determined on the basis of the relationship:

$$\phi_{\mathrm{opt}} = \pi\sqrt{1-\left(\frac{\Delta \mathrm{nd}}{\lambda_0}\right)^2} \qquad [6]$$

23. Method according to one of claims 18 to 22, characterized by the fact that the rotatory power PR is calculated on the basis of a twist value imposed by the azimuthal anchoring.

24. Method according to one of claims 18 to 23, characterized by the fact that it comprises a step of adaptation of the

angles of the polarizers in order to improve the colorimetric neutrality of the white obtained.

25. Method according to one of claims 18 to 24, characterized by the fact that the rotatory power PR is calculated on the basis of a twist value which integrates an uncoupling (DE) resulting from a finite azimuthal anchoring.